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CASE REPORT

# Endovascular repair of traumatic rupture of the descending aorta

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## Case report

A 70-year-old lady was involved in a road traffic accident, in which a heavy goods vehicle at high speed shunted her stationary vehicle. At presentation she was unconscious (Glasgow Coma Scale 5), she was fluid resuscitated, ventilated and admitted to a local hospital. Once the extent of her injuries was known she was transferred to the Leicester Royal Infirmary. Examination and investigation of the patient revealed an acute aortic rupture at the level of the aortic isthmus. This injury was associated with a descending aortic dissection flap, and a large mediastinal haematoma (Fig. 1). In addition, she was found to have diffuse swelling of the brain, but no compromise of basal cisterns, fractures of left maxilla and mandible, pulmonary contusions, and fractures of the sacrum and right inferior pubic ramus with collections in both hemipelvises suggestive of pelvic bleeding. Abdominal viscera were intact. Clinically, the patient was in respiratory failure, and had worsening acute renal failure.

The consensus view by cardiac surgical and anaesthetic teams was that this lady would not survive open repair of her aortic rupture, due to respiratory failure, precluding single lung ventilation, and the risk of further haemorrhage secondary to heparinisation required for cardiopulmonary bypass. Despite close fluid management over the next 72 h, the patient remained hypotensive, her renal function continued to deteriorate, and ventilation became progressively more difficult.

It was decided that stent-grafting of the aorta should be performed to prevent further aortic haemorrhage. Ninety hours post rupture, the patient was transferred to the operating theatre for stent-grafting of the descending thoracic aorta. Under general anaesthetic a 36 mm Talent™ (Medtronic AVE, Sunnyvale, CA, U.S.A.) endovascular stent-graft was sited across the aortic injury. In order to ensure adequate fixation, the origin of the left subclavian artery was covered. Angiography confirmed adequate placement of the stent with flow into the left common carotid and brachiocephalic arteries, but no flow into the left subclavian artery. Despite a contrast enhanced CT scan confirming adequate calibre vessels, withdrawal of the deployment sheath caused a rupture of the right external iliac artery. The degree of haemorrhage secondary to rupture of the external iliac artery precluded endoluminal stenting and was repaired by insertion of a synthetic graft from the right common iliac artery to the right femoral bifurcation.

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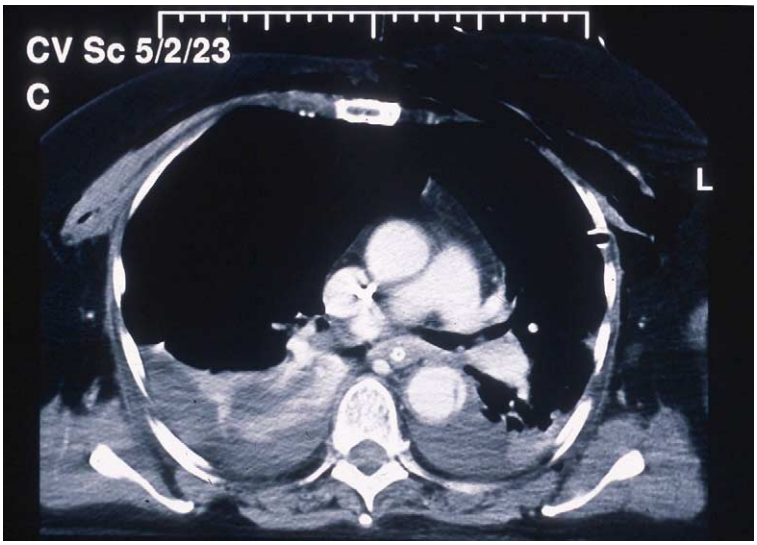


**Figure 1** CT radiograph demonstrating aortic dissection flap and mediastinal haematoma.

The patient returned to the intensive care unit and remained haemodynamically stable. Unfortunately active therapy was withdrawn 2 days later due to worsening respiratory and renal failure.

## Discussion

Thoracic aortic transections (TATs) most commonly occur as a result of rapid deceleration injuries, as encountered in high speed road traffic accidents.[3] Less than 20% of patients reach hospital alive, with 30% of these survivors dying before surgery.[11] Inevitably patients with TAT present with concurrent cerebral, pulmonary, abdominal and orthopaedic injuries, and their associated sequelae. Of all, 52.4% of patients with TAT require operation for other injuries.[2]

The site of traumatic aortic transection in 74—97% of cases is the aortic isthmus, just distal to the origin of the left subclavian artery.[2,12,13]

Traditionally, open repair of TATs has been performed. Operative mortality with these procedures is reported to be 15—20%, with an incidence of paraplegia at 3—8%.[7,10,11] Consequently, it has been postulated that immediate open repair should only be considered for unstable patients, with delayed repair being more appropriate for patients with severe concomitant injuries.[2,4,9,13] In delayed repair, pre-operative status may be optimised whilst the risk of further bleeding from the aorta may be minimised by maintaining relative hypotension.

The introduction of endovascular stent-grafting (ESG) allows the treatment of patients with TAT using less invasive methods. There is no requirement for aortic cross-clamping, thoracotomy, single lung ventilation or full heparinisation. In addition, access via femoral arteriotomy can be performed under local or regional anaesthesia, and blood loss is minimal. It would, therefore, seem that ESG is ideal for unstable patients with severe concomitant injuries, such as right lung injury, central nervous system injury, severe burns or large open wounds, in whom immediate repair is associated with increased mortality and comorbidity.[1,4,16] Early repair of TATs also removes the need for maintenance of hypotension, to prevent further aortic haemorrhage, which may be detrimental to the management of concurrent injuries, such as renal failure and pulmonary injury. Unfortunately the number of reported cases of ESG for TAT are few, and there are no large scale studies comparing ESG with open repair in the immediate management of TAT.[1,4,8,15,16] Complication rates for emergency/urgent ESG in thoracic aortic pathology are reported as being favourable. Thompson et al. reported six cases of TAT (time of presentation to ESG, 14 h to 5 days), hospital mortality and paraplegia rates were 0%.[15] Bell et al. reported 24 cases (time of presentation to ESG: 9, $<$24 h; 11, $<$48 h; 4, $<$72 h), 30-day survival was 83.3% (20/24), with transient paraplegia in one case.[1]

In principle, the safety of ESG requires adequate distal arterial size for arteriotomy, with limited vessel tortuosity, and satisfactory proximal and distal necks for graft placement. The adequacy of distal arterial access should be assessed using contrast enhanced CT scanning. In the case of TAT, ESG is further complicated because the majority of ruptures occur at the aortic isthmus. As a consequence,

curvature of the aortic arch and the exact origin of the left subclavian artery may make graft placement technically difficult and increase the risk of perigraft leakage (endoleak) and subclavian artery thrombosis.[14] Analysis of the data since 2001 revealed that of 33 reported cases of thoracic aortic ESG, only three patients demonstrated endoleak, of these two were successfully managed angiographically with further stent placement whereas one patient required stent removal and open repair 6 weeks after insertion.[1,4,6,15,16] Although coverage of the left subclavian artery origin during ESG would appear to be deleterious, the current literature suggests that in the acute situation it is safe, with no cases of acute limb ischaemia reported in 15 cases.[1,4,5,8] Residual limb claudication may be treated by elective carotid—subclavian bypass.

The greatest limit to the use of ESG in TAT is the need for an experienced team of endovascular specialists, appropriate angiography and CT scanning equipment, and the free availability of appropriate stent grafts in a range of sizes and aortic arch contours. This latter point reflects the fact that different graft manufacturers have different delivery devices and different graft curvatures, which may influence the choice of graft for various aortic arch morphologies and in patients with difficult peripheral arterial access.

We conclude that ESG is an important treatment modality for TAT and should be used in unstable patients where the mortality and comorbidity of open repair are precluded. In addition, ESG should be considered as a first line treatment for TAT in older patient groups in whom morbidity and mortality rates may prohibit open repair. Further evaluation of the techniques, long term follow-up of patients who have undergone ESG, and controlled trials are required to assess the efficacy of this technique in all patients, and especially young patients, requiring thoracic aortic repair.

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